98B-166

4.5 PSP Cover Sheet (Attach to the front of each proposal)

Proposal Title: Focused Action to Develop Ecologically-Based Hydrologic Models and Water Management Strategies in the San Joaquin Bas
Applicant Name: Natural Heritage Institute (NHI)
Mailing Address: 114 Sansome St, Suite 1200, San Francisco, CA 94104
Telephone: (415) 288-0550
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Amount of funding requested: $ 295,925 for 1 years

Indicate the Topic for which you are applying (check only one box).

- ☐ Fish Passage/Fish Screens
- ☒ Habitat Restoration
- ☐ Local Watershed Stewardship
- ☐ Water Quality
- ☐ Introduced Species
- ☐ Fish Management/Hatchery
- ☐ Environmental Education

Does the proposal address a specified Focused Action? ✓ yes _____ no

What county or counties is the project located in? San Joaquin, Stanislaus, Merced, Madera, Fresno counties

Indicate the geographic area of your proposal (check only one box):

- ☐ Sacramento River Mainstem
- ☐ Sacramento Trib: _____
- ☐ San Joaquin River Mainstem
- ☒ San Joaquin Trib: _____
- ☐ Delta: _____
- ☐ East Side Trib: _____
- ☐ Suisun Marsh and Bay
- ☐ North Bay/South Bay: _____
- ☐ Landscape (entire Bay-Delta watershed)
- ☐ Other: _____

Indicate the primary species which the proposal addresses (check all that apply):

- ☒ San Joaquin and East-side Delta tributaries fall-run chinook salmon
- ☐ Winter-run chinook salmon
- ☐ Late-fall run chinook salmon
- ☐ Delta smelt
- ☐ Splittail
- ☐ Green sturgeon
- ☐ Migratory birds
- ☐ Other: _____
- ☐ Spring-run chinook salmon
- ☐ Fall-run chinook salmon
- ☐ Longfin smelt
- ☐ Steelhead trout
- ☐ Striped bass
- ☐ All chinook species
- ☒ All anadromous salmonids

Specify the ERP strategic objective and target (s) that the project addresses. Include page numbers from January 1999 version of ERP Volume I and II:

Floodplains and flood processes, pg. 89
Streamflows, pg. 39
Coarse sediment supplies, pg. 73

I. Title Page

A. Project Title: Focused Action to Develop Ecologically-Based Hydrologic Models and Water Management Strategies in the San Joaquin Basin

B. Primary Contact: Natural Heritage Institute
John Cain
114 Sansome Street, Suite 1200
San Francisco, CA 94104
Phone: (415)288-0550, Fax: (415)288-0555
Email: jcain@n-h-i.org

C. Participants and Collaborators: Natural Heritage Institute (NHI)

The Nature Conservancy (TNC)

G. Mathias Kondolph, Ph.D

McBain and Trush

Stillwater Sciences

D. Type of Organization: Non-Profit, 501 (c)(3), tax exempt

E. Tax Identification Number: 94-3099600

II. Executive Summary

A. Project Description

Although the Strategic Plan prioritizes re-establishment of more dynamic, natural high-flow regimes in regulated rivers, it neither specifies criteria for quantifying these flows nor does it identify realistically achievable water management and acquisition strategies.

This project will illustrate state-of-the-art scientific approaches for developing water management operations compatible with both environmental and other water supply objectives. We will demonstrate a method for identifying the flow regimes necessary to achieve ecological restoration objectives, and we will identify opportunities for achieving those target flow regimes through modifications in reservoir and water management operations in the San Joaquin Basin, without undesirable water supply impacts on water users.

Project applicants will pursue a 3-step process:

1. Demonstrate a range of methods for identifying the high flow regimes necessary to achieve ecological restoration objectives.
2. Identify and model integrated water management strategies designed to achieve high flow restoration targets without creating water supply impacts in the San Joaquin Basin.
3. Develop criteria for optimizing compensated water acquisitions to achieve hydrologic restoration targets beyond what is possible with the management innovations evaluated in step two.

B. Location

CALFED East San Joaquin Basin Ecological Management Zone (figure 1).

C. Biological/Ecological Objectives

The primary objective of this project is to identify strategies for restoring:

- frequency of high stream flows in regulated rivers sufficient to maintain channel habitat conditions favorable to native aquatic and riparian species (Strategic Plan Goal 2, Objective5 ERP pg.54).
- flood plains and flood flow processes in regulated rivers by providing flow releases capable of inundating flood plains (Strategic Plan Goal 2, Objective 6; ERP pg. 89)

D. Cost

This effort will be developed in the following three phases. **This proposal is for Phase I only.**

Phase I: Analysis and modeling of hydro-biologic issues and water management.
10/1999 10/2000 $295,925

Phase II: Design flow release and adaptive management experiments.

Phase III: Implementation and monitoring.

E. Third Party Impacts

Because the purpose of the project is to identify opportunities which will have no negative impact on water supply water users, there should be no negative economic or socio-economic impact. The water ecological and drinking water quality benefits that could accrue from high flow restoration would be very substantial.

F. Applicant Qualifications

The Nature Conservancy (TNC) and Natural Heritage Institute (NHI) will manage this project collaboratively, with NHI serving as fiscal agent and prime contractor. Our approach will be to assemble the best available expertise into two teams to guide the project, including: Luna Leopold and Peter Moyle, renowned hydrologist and fish biologist and NHI trustees, Matt Kondolf, William Kimmerer, Stillwater Associates, and McBain and Trush, which has significant expertise in applying their alluvial attributes approach to recommending flow releases and developing restoration strategies for the Trinity River in Northern California and Tuolumne River.

NHI is a nonprofit natural resources law and technical consulting firm committed to improving the management and conservation of natural resources with expertise in water management and habitat restoration. NHI has been a leading representative of the environmental community in the CALFED process.

Dr. Brian Richter, Director of the TNC's Freshwater Initiative, has extensive experience in establishing the importance of natural flow regimes and has worked with science staff and conservation project teams across the U.S. to identify key hydrologic processes supporting biological diversity, assess alterations to these processes, and design conservation strategies for restoring desired hydrologic conditions.

G. Monitoring and Data Evaluation

We will assume that natural flow variability and natural geomorphic patterns are more desirable than heavily engineered flows for target aquatic species such as chinook salmon. We will characterize natural flow variability and contrast it with present flow regimes using an approach developed by Richter (1988). This technique uses aerial photographs and existing geomorphic studies to determine natural geomorphic characteristics, then correlates geomorphic change with changes in hydrology. Hydrologic regimes that result in desirable (natural) geomorphology will then be identified as target flows, and our water management team will set out to identify strategies for supplying target flow regimes without impacting existing water supplies. Features from aerial photographs will be digitized to a rectified base map.

H. Local Support/Coordination

NHI has longstanding working relationships with the agricultural water districts in the San Joaquin basin which will greatly facilitate working with them to identify opportunities and constraints in this project. For four years, NHI has been collaborating with CVP districts in demonstrating a variety of economic incentives for water conservation in agriculture. NHI has also recently worked with both the San Joaquin tributary water districts and the export water users in the basin in forging the Vernalis Adaptive Management Program to provide environmental water flows to achieve the purposes of the Bay-Delta Water Quality Control Plan, an exercise in cooperative problem solving that will be of value in carrying out this proposal.

I. Compatibility with CALFED Objectives

This project addresses the following ERP strategic objectives and targets: Floodplains and flood processes, pg. 89; Streamflows, pg. 39; Coarse sediment supplies, pg. 73; Stream meander, pg. 76. The ERP and the Strategic Plan are based on the philosophy that restoring these physical processes will be beneficial for nearly all habitat and species objectives.

III. Project Description

A. Proposed Scope of Work

This project capitalizes on the opportunity to "mimic natural flow regimes through innovative methods to manage reservoir releases" as one of the key CALFED objectives for restoration of riverine ecosystems (pg. 42 of ERP). The CALFED plan recognizes that:

> "There is underutilized potential to modify reservoir operations rules to create more dynamic, natural high-flow regimes in regulated rivers without seriously impinging on the water storage purposes for which the reservoir was constructed. Water release operating rules could be changed to ensure greater variability of flow, provide adequate spring flows for riparian vegetation establishment, simulate effects of natural floods in scouring riverbeds and creating point bars, and increase the frequency and duration of overflow onto adjacent floodplains" (pg 42).

Although the Strategic Plan prioritizes re-establishment of more dynamic, natural high-flow regimes in regulated rivers, it neither specifies criteria for quantifying these flows nor does it identify realistically achievable water management and acquisition strategies. This project will illustrate water management innovations compatible with both environmental and other water supply objectives. Some illustrative examples are described in the technical feasibility section of this proposal.

This proposal is for Phase I of a three phase process:

- Phase I: Analysis and modeling of hydro-biologic issues and water management
- Phase II: Design flow release and adaptive management experiments
- Phase III: Implementation and monitoring.

During phase I, project applicants will pursue a 3-step process:

1. Demonstrate a range of methods for identifying the high flow regimes necessary to achieve ecological restoration objectives.
2. Identify and model integrated water management strategies designed to achieve high flow restoration targets without creating water supply impacts in the San Joaquin Basin.
3. Develop criteria for optimizing compensated water acquisitions to achieve hydrologic restoration targets beyond what is possible with the management innovations evaluated in step two.

Task #1: Identify the timing, frequency, magnitude, and duration of flood flows necessary to regenerate and sustain native riparian vegetation, fish, and other aquatic organisms as well as natural floodplain and alluvial river processes

Task 1A: Describe the problems created by the regulated annual flow regimes on the alluvial rivers of the San Joaquin River Basin.

Utilize Richter (1998) approach to characterize the natural ranges of variation in river flow conditions that sustained native biota and the ecological integrity of these river systems prior to substantial human influence and contrast with present-day flow variability for key river segments throughout the basin, quantitatively describe and contrast historic with contemporary alluvial channel morphology.

Task 1B: Hypothesize the degree to which hydrologic and geomorphic conditions of these alluvial river ecosystems need to be restored to achieve ecological restoration objectives.

Convene two workshops of outstanding geomorphologists, biologists, ecologists, and other experts to formulate testable hypotheses about the geomorphic and ecological consequences of human alterations to key flow characteristics (intra- and inter-annual) and the sediment supply. Hypothesize how specific geomorphic

and hydrologic attributes will affect target species and habitats such as salmon smolt production or recruitment of riparian vegetation. Identify physical processes critical to maintaining dynamic alluvial channels, and associate those processes with components of the unregulated annual hydrograph. Determine which processes and annual hydrograph components are missing and/or impaired and stimulate the threshold of hydrologic alterations that are ecologically tolerable and consistent with achieving the ERP goals.

Task 1C: Refine hypotheses developed in 1B regarding the flow characteristics and annual hydrograph components necessary to achieve specific restoration goals by contrasting them with a field-based approach underway on the Tuolumne River.

Draw upon existing historic geomorphic, hydrologic, aquatic and riparian studies to support or refine hypotheses regarding the tolerable thresholds of hydrologic modification. There is a considerable body of existing work on historical channel change, bed mobility, sediment deficit, and changes in riparian vegetation and aquatic habitat in the San Joaquin, Merced, Tuolumne, and Stanislaus Rivers. The applicants have either conducted (or supervised) these studies or are familiar with them.

Task 1D: Develop peer-reviewed performance criteria and monitoring protocols for long-term adaptive management.

Develop a process for field testing whether: 1) specified flow restoration strategies achieve desired physical attributes, and 2) whether restoration of physical attributes leads to attainment of ecological goals (e.g., increased populations of target species). This process will enable scientists and managers to quantitatively link biological assessment (e.g., predicting population responses) directly to management prescriptions using appropriate geomorphic response-variables. Likewise, link quantifiable ecosystem benefits directly to prescribed flow variability. A primary objective of our interdisciplinary project panel will be to identify candidate variables and identify methods for their measurement.

Schedule: First and second quarter.

Deliverable: A graphically rich report describing hydrologic changes, hypothesis, preliminary flow targets for San Joaquin tributaries, and monitoring approaches.

Task #2: Identify innovative water management strategies for modifying reservoir release operations or reconfiguring water delivery schedules and practices in the San Joaquin Basin to maximize ecological benefit without creating undesirable water supply or flood control impacts.

Existing models are not easily configured to perform this analysis because they typically operate at monthly time steps, while the flow patterns of concern frequently take place on much shorter time scales while the flow patterns of concern in this case frequently take place on a time scale far shorter than a month. For this reason, we will analyze opportunities for changed operations by working directly with recent historical flow and storage data, as modified to reflect newer instream flow requirements (if any exist). We will, itteratively, walk through a sequence of years to determine whether we could have operated the system differently in order to generate increased ecological benefits without reducing water supplies or flood control protections. Lessons learned from early itterations will be used to improve operations during later iterations of the game.

This "gaming" exercise would operate in a manner very similar to the gaming which CALFED has recently undertaken to evaluate the Environmental Water Account (EWA). The outputs from this game can then be compared to the original trace to determine how close we were able to come to the hydrological targets defined in Task #1. Indeed, the EWA may be a useful mechanism for managing these types of modifications to water district operations. Finally, we will identify the extent to which different management opportunities achieve ecologically necessary flow targets, and the size, timing, and relative value of shortfalls in target flows.

Schedule: Third quarter

Deliverable: A report identifying and quantitatively evaluating different water management techniques for achieving project objectives.

Task #3: Identify management and acquisition strategies for achieving desired goals where water management innovations are insufficient for achieving restoration targets. We will examine strategies for meeting the target flow characteristics and hydrograph components on selected San Joaquin Basin tributaries. This Task is similar to Task #2, but now includes the possibility of the acquisition and manipulation of water by environmental agencies. Thus, we will examine the utility of water purchases, groundwater storage, and other management tools to allow the implementation of a more favorable hydrological regime without impact on water users. We will also integrate San Joaquin Basin operations into the kinds of operations envisioned for the EWA. Thus, for example, water acquired in the San Joaquin Basin to meet local environmental needs might be pumped at the Delta as EWA water or backed into upstream storage for future release. Similarly, EWA water held on the Sacramento River or in the export areas might be backed into the San Joaquin Basin in preparation for a needed high flow event. Thus, broader integration should reduce overall program costs. Ultimately, we will identify a "compromise" flow regime that will achieve the greatest ecological benefits with water that is available and make recommendations for augmenting this regime as water is made available through various means. We will classify acquisition opportunities, develop criteria to guide acquisition decisions, and prioritize the timing, frequency, magnitude and durations of timing.

Schedule: Fourth quarter

Deliverable: A report recommending flow targets, water management innovations, acquisitions strategies and monitoring protocol jointly authored by the highest caliber expertise.

Task #4: *Public outreach and agency coordination:* Numerous agencies and stakeholders have jurisdiction or interest in water management in the San Joaquin River Basin. NHI will coordinate meetings with agencies including USBR, DWR, and ACE, local water and flood control districts, and other stakeholders to explain this study and discuss opportunities and constraints for water management innovations.

Schedule: All four quarters

Task #5: Project management and oversight: NHI will act as the prime contractor and fiscal administrator. NHI and TNC will jointly make decisions regarding project scope, budget, and direction. NHI will let sub-contracts to The Nature Conservancy, McBain and Trush, and Stillwater Sciences and will organize and retain independent experts for Task 1 workshops and to otherwise complete the project.

Schedule: All four quarters

B. Location and Geographic Boundaries

CALFED East San Joaquin Basin Ecological Management Zone (figure 1).

IV. Ecological/Biological Benefits

A. Ecological/Biological Objectives

The primary objective of this project is to identify strategies for restoring:

- frequency of high stream flows in regulated rivers sufficient to maintain channel habitat conditions favorable to native aquatic and riparian species (Strategic Plan Goal 2, Objective5 ERP pg.54).
- flood plains and flood flow processes in regulated rivers by providing flow releases capable of inundating flood plains (Strategic Plan Goal 2, Objective 6; ERP pg. 89)

Central Valley rivers were once capable of continually shaping and reshaping their banks and bed. Loss of this alluvial capability, due primarily to dams and flow regulation, has been at the core of most ecological impacts, such as impaired physical salmon habitat and declining riparian communities. Alluvial channel dynamics are sufficiently understood to begin recommending annual flow releases intended to restore critical alluvial processes, though the ecological significance of this alluvial restoration must be stated more quantitatively.

Alluvial rivers exhibit a wide range of physical processes. Variable inter-annual and intra-annual flows are the agents for these physical processes. Bankfull discharges are important for channel maintenance and long-term sediment transport, whereas larger magnitude floods reshape prominent alluvial features such as alternating bars. Even larger floods build floodplains and occasionally reset riparian vegetation communities. Variable flows also elicit a range of biological responses. For example, different baseflows interact with the channel morphology to produce different types and amounts of preferred habitat. Thus, variable flow regimes provide the full array of processes and responses that build and water contemporary channels. Morphological and ecological complexity is the tangible outcome of flow variability. The extreme variability in river flow produced a range of conditions, from low-water stress during annual dry seasons and during droughts, to intense scouring during large floods. Native species, such as anadromous salmon, were adapted to these conditions. With the advent of extensive reservoir storage and flow regulation, Central Valley rivers have become invaded by exotic species, which evidently thrive in the artificially regulated flow regime but may not have competed successfully under natural hydrologic conditions. Many of these exotic species prey upon native salmon.

Prescription of inter-annual flow variation will require a quantitative appreciation for key physical processes and biological responses as well as adhering to quantitative restoration objectives. A primary objective which we will break down into specific objectives, which can inform restoration planning and implementation, and against which the performance of restoration actions can be quantitatively assessed is to restore alluvial channel dynamics to mainstem Central Valley channels. The key to prescribing variable flows has been to satisfy geomorphic requirements while anticipating other important processes/responses have not been adequately considered or envisioned. Flow timing in the annual hydrograph, as in peak snowmelt runoff, triggers many dependent biological responses. For example, early peak runoff will favor one amphibian's life history needs over another's more adapted to late seasonal runoff. There are many other examples. Having a flow release protocol responsive to natural inter-annual runoff patterns and variable intra-annual flows will provide needed variability without identifying and/or quantifying all potential biological responses.

The approach for identifying flow regimes is necessarily simple. Project applicants considered more elaborate, time consuming, modeling and field intensive approaches, but concluded that the only way to ever precisely identify the relationships between high flows and target species was to release high flows and measure their effect over time. Since this is not presently feasible given California's water supply constraints, identifying

strategies to better utilize existing water to achieve presumably beneficial high flows is the challenge. Thus, the project team will rely largely on existing data, simple correlation analysis, and expert opinion to develop flow targets and then evaluate water management strategies for achieving them without water supply impacts.

Natural geomorphic characteristics will be identified from aerial photographs and existing geomorphic studies on the Tuolumne, San Joaquin and Merced Rivers. Existing time series of vegetation and channel change from these rivers will be correlated with historical hydrology to determine the causal relationship between hydrograph components and geomorphic response variables. Hydrologic regimes that result in desirable (natural) geomorphology will then be identified as target flows, and our water management team will set out to identify strategies for supplying target flow regimes without impacting existing water supplies. Richter and Richter recently used this approach on the Yampa River in Colorado (B. Richter and H. Richter, "Prescribing Flood Regimes to Sustain Riparian Ecosystems Along Meandering Rivers," in press *Conservation Biology*).

B. Linkages to Past, Present, and Future Projects

This project addresses the following ERP strategic objectives and targets: Floodplains and flood processes, pg. 89; Streamflows, pg. 39; Coarse sediment supplies, pg. 73; Stream meander, pg. 76. The ERP and the Strategic Plan are based on the philosophy that restoring these physical processes will be beneficial for nearly all habitat and species objectives.

C. System-Wide Ecosystem Benefits

This project will identify flow regimes that have a widespread effect on the entire length of the San Joaquin River tributaries, the Delta, and San Francisco Bay. Target habitats and species at every point along the hundred of miles of channels would benefit from such a flow regime. We have chosen to focus on the San Joaquin tributaries because their flood flow regimes have been so drastically altered, but the results of this analysis will be applicable throughout the Central Valley.

Management strategies for increasing flow variability could have these collateral ecosystem benefits: (1) sequencing peak flow releases from tributaries to meet Delta inflow standards, (2) allowing greater overbank flows over more natural durations and at the ecologically-appropriate time, in combination with a dedicated floodway corridor, to free reservoir space currently dedicated to mandatory flood reservation storage, (3) recharging depleted aquifers by rewatering abandoned channels and floodplains while simultaneously increasing overall water storage and yield, and (4) recapturing a portion of simultaneous peak releases from the tributaries (that cumulatively may exceed necessary Delta outflows) for consumption or groundwater banking.

D. Compatibility with Non-Ecosystem Objectives

Because the purpose of the project is to identify opportunities which will have no negative impact on water supply water users, there should be no negative economic or socio-economic impact. The water ecological and drinking water quality benefits that could accrue from high flow restoration would be very substantial.

V. Technical Feasibility and Timing

Like the authors of the strategic plan, we are confident that it is possible to modify reservoir release to achieve high flows without creating water supply impacts. For example, during wet years, many reservoirs are operated to release moderate flows for several weeks or months. These prolonged moderate flows can result in decreased channel complexity and degraded aquatic habitat. The natural flow regimes of these river systems would include shorter duration, higher magnitude "overbank" flows. Restoration of natural-like flood flows could provide substantial geomorphic and ecological benefits without increasing the total amount of water released.

It is also possible to increase geomorphic and ecological benefits with flows already required to meet Delta water quality standards. For example, depending on year type (wet, dry), flows of 4,000 to 7,000 c.f.s. at Vernalis will most likely be required to meet Delta water quality standards. Most of this water will be obtained from releases from the San Joaquin River tributaries. Rather than releasing an equal and static amount of water from each of these tributaries, short-duration high flows approximating 4,000-7,000 cfs could be released sequentially from each of these tributaries.

NHI recently used the WEAP model to demonstrate the technical feasibility of rewatering the San Joaquin River below Friant Dam without reducing water supplies to the Friant Service area. NHI's plan for rewatering the San Joaquin River includes a new water delivery configuration that would move Delta water, currently delivered to the Delta Mendota Exchange Contractors at Mendota Pool, to the Friant Service Area via the California Aqueduct in exchange for increased releases from Friant Dam. Delta water foregone by the Exchange Contractors would be offset by increased releases from Friant Dam thereby rewatering the dry reach of river between Mendota Pool. Water percolated to the aquifer in this porous reach of river would be banked as groundwater for use in drier periods.

The Nature Conservancy is working with the Northwest Florida Water Management District and the US Fish and Wildlife Service to demonstrate that human water supply needs in the Apalachicola-Chattahoochee-Flint (ACF) river basin in the Southeast can be met while sustaining relatively natural flow regimes. This work is being performed in support of negotiations of a water allocation formula among three states: Florida, Georgia, and Alabama. Using a hydrologic simulation model that operates on a daily time step, it has been demonstrated that by modifying existing reservoir rule curves and carefully managing the timing and volume of ground water extraction and surface diversions, human needs can be met for coming decades while minimally altering natural flow regimes. The State of Florida is now proposing to incorporate these water management changes into the three-state water compact for the ACF basin.

VI. Monitoring and Data Collection Methodology

A. Biological/Ecological Objectives

The primary hypothesis that this project will evaluate and refine is that:

- Variable high flow regimes are beneficial to the maintenance of native aquatic species.

It is well established that high flows precipitate physical movement of the channel and its bed, causing changes in channel form and location over time. A great body of ecological literature suggests that species diversity is positively correlated to an intermediate level of disturbance and that many species have evolved to exploit disturbance regimes imposed by changes in flow and channel form. It is uncertain, however, how these flows and channel forms they create effect various aquatic organisms, but it is certain that these change effect different species in different ways. Untangling this web of relationships between hydrology, geomorphology, and ecology will take decades of adaptive management monitoring.

B. Monitoring Parameters and Data Collection Approach

We don't pretend to be able to answer these questions with this proposal, but we do think that we can move the process forward. Water scarcity is the primary constraint to releasing hypothetically beneficial high flows from reservoirs. As long as water managers assume that releasing high flows will necessarily reduce water supply yields, little progress toward restoration or understanding high flow and flood flow processes will be made. The primary purpose of this project will be to identify strategies for releasing beneficially high flow regimes without impacting water supplies. To succeed we must first identify the components of the hydrograph that are most important to 1) economize scarce water and 2) to establish a target against which water management strategies will be evaluated.

We will assume that natural flow variability and natural geomorphic patterns are more desirable than heavily engineered flows for target aquatic species such as chinook salmon. We will characterize natural flow variability and contrast it with present flow regimes using an approach developed by Richter (1988). Natural geomorphic characteristics will be identified from aerial photographs and existing geomorphic studies on the Tuolumne, San Joaquin and Merced Rivers. Existing time series of vegetation and channel change from these rivers will be correlated with historical hydrology to determine the causal relationship between hydrograph components and geomorphic response variables. Hydrologic regimes that result in desirable (natural) geomorphology will then be identified as target flows, and our water management team will set out to identify strategies for supplying target flow regimes without impacting existing water supplies.

New aerial photo mapping and ground truthing will be conducted to characterize hydrologic and geomorphic change during the recent wet period. For focused study reaches, vegetation extent, vigor, and species composition will be evaluated; channel form measured, and bed size quantified with wolman pebble counts. Arboreal and arbuscular species distribution and extent will be mapped from aerial photographs and field visits will be conducted to verify genus. Previously surveyed stream reaches will be revisited to document change during the channels will be surveyed. Channel cross sections, elevation, and bed material size will be measured.

C. Data Evaluation Approach

Features from aerial photographs will be digitized to a rectified base map. The accuracy and precision of the base map will meet the requirements for locating features in the field and for referring to the locations of features and conditions in the final project Report. Channel cross sections and elevations will be measure with a self-leveling optical devise that will be able to detect elevation changes of ± 0.01 ft. A frequency distribution of coarse sediment size will be conducted using the Wolman method whereby the intermediate diameter of a 100 gravels is measured within an approximately 200 square foot area to ascertain the D_{50} and D_{84} sediment size at that location.

VII. Local Involvement

NHI has longstanding working relationships with the agricultural water districts in the San Joaquin basin which will greatly facilitate working with them to identify opportunities and constraints in this project. For four years, NHI has been collaborating with CVP districts in demonstrating a variety of economic incentives for water conservation in agriculture. That has resulted in setting up an electronic water market with the twenty-seven districts in the San Luis & Delta Mendota Water Authorities on the west side. NHI has also recently worked with both the San Joaquin tributary water districts and the export water users in the basin in forging the Vernalis Adaptive Management Program to provide environmental water flows to achieve the purposes of the Bay-Delta Water Quality Control Plan. This too has been an exercise in cooperative problem solving that will be of value in carrying out this proposal.

At the county level, we have notified the Chairman of the Board of Supervisors and a representative of the County Planning Department for the following counties: San Joaquin, Madera, Merced, Fresno, and Stanislaus counties. Letters of notification are attached.

Permission for property use or access is not applicable.

Because the purpose of the project is to identify opportunities which will have no negative impact on water supply water users, there should be no negative economic or socio-economic impact on local water users. The water ecological and drinking water quality benefits that could accrue from high flow restoration would be very substantial.

VIII. Cost

A. Budget

NHI will act as the prime contractor and fiscal administrator. NHI and TNC will jointly make decisions regarding project scope, budget, and direction. NHI will let sub-contracts to The Nature Conservancy, McBain and Trush, and Stillwater Sciences and will organize and retain independent experts for Task 1 workshops and to otherwise guide and add additional expertise to the project tasks.

Table 3 depicts a budget for the project organized by project tasks and cost categories. Please note that this budget reflects costs of NHI and TNC personnel and costs of retaining highly skilled and experienced experts to assist in the project tasks.

Table 4 depicts a sample quarterly budget.

B. Schedule

This effort will be developed in the following three phases. **This proposal is for Phase I only.**
See Table 5 for schedule by Task.

Table 5

Phase I: Analysis and modeling of hydro-biologic issues and water management.

- **Task 1:** Identify the timing, frequency, magnitude, and duration of flood flows necessary to regenerate and sustain native riparian vegetation, fish, and other aquatic organisms as well as natural floodplain and alluvial river processes. **10/1999 3/2000**
- **Task 2:** Identify innovative water management strategies for modifying reservoir release operations or reconfiguring water delivery schedules and practices in the San Joaquin Basin to maximize ecological benefit without creating undesirable water supply or flood control impacts. **4/2000 6/2000**
- **Task 3:** Identify management and acquisition strategies for achieving desired goals where water management innovations are insufficient for achieving restoration targets. **7/2000 10/2000**
- **Task 4:** Public outreach and agency coordination. **10/1999 10/2000**
- **Task 5:** Project management and oversight. **10/1999 10/2000**

Phase II: Design flow release and adaptive management experiments.
Phase III: Implementation and monitoring.

TABLE 3: SAMPLE BUDGET

Project Phase and Task	Direct Labor Hours	Direct Salary and Benefits	Service Conracts, Dollars	Material and Acquisition Contracts, Dollars	Misc. and Other Direct Costs, Dollars	Overhead and Indirect Costs, $	Total Cost $
Phase 1: Analze bio-hydrologic relationships and water management opportunities						0	0
1. Estimate the flow regime necessary to achieve restoration objectives						0	0
a. Describe problems associated with regulated flow regimes		0				0	0
i. Compile existing data and reports	60	3,000	5,000			750	8,750
ii charaterize hydrologic changes	120	4,800				1,200	6,000
iv. Describe observed changes in channel morphology and ecology	80	3,600				900	4,500
v. Draft report describing hydrologic changes	80	4,800				1,200	6,000
b. Develop hypotheses and recomendations re: flows						0	0
i. Convene, and facilitate work-shops	40	1,600	15,000		3,500	400	20,500
ii. Draft a discussion paper outlining potential hypotheses and mechanisms	60	5,400	10,000			1,350	16,750
iii. Draft report on workshop findings	40	3,600				900	4,500
c. Test and refine key hypotheses						0	0
i. Compile and evaluate geomorhic and vegetation maps (GIS)	120	4,800				1,200	6,000
ii. Collect new data and conduct new mapping to augment existing maps.	200	10,000	20,000		2,500	2,500	35,000
iii. Correlate geomorphic change with hydrologic variables	140	8,400	10,000			2,100	20,500
iv. Refine hypothesis with data from previous gstudies of tributaries			15,000			0	15,000
v. Draft report on hypothesis testing methods and results	40	1,600	5,000		250	400	7,250
d. Reconvene workshop to develop monitoring	90	3,600	15,000		3,500	900	23,000
2. Identify and model integrated water management strategies						0	0
a. Alternative water management analysis	60	3,300	10,000			825	14,125
b. Spreadsheet gamming analysis of historical flow data to achieve flow regime without water supply impact	400	16,000	15,000			4,000	35,000
c. Characterize the timing, frequency and value of shortfalls	40	2,200				550	2,750
d. draft a report describing water management opportunities analysis	100	5,500			1,500	1,375	8,375
3. Identify acquisition strategies and other transactional mechanisims for achieving desired goals						0	0
a. analyze acquisition strategies	120	6,000				1,500	7,500
b.Identify a "compromise" flow regime	100	8,000				2,000	10,000
c.Develop criteria for acquisition	140	7,700			1,500	1,925	11,125
4. Public outreach and agency coordinations	200	10,000				2,500	12,500
5. Project management and oversight		0				0	0
a. develop project approach	60	2,400				600	3,000
b.review and edit project deliverables	120	4,800				1,200	6,000
c.reporting and fiscal administration	96	3,840				960	4,800
d.inspect work product, validate costs	140	5,600				1,400	7,000
TOTAL	**2,646**	**130,540**	**120,000**		**12,750**	**32,635**	**295,925**

I-016052

TABLE 4: SAMPLE QUARTERLY BUDGET

Task	Quarterly Budget Oct-Dec 1999	Quarterly Budget Jan-Mar 2000	Quarterly Budget April-June 2000	Quarterly Budget July-Sep 2000	Total
1. Estimate the flow regime necessary to achieve restoration objectives	86,875	86,875			173,750
2. Identify and model integrated water management strategies	20,083	20,083	60250		60250
3. Identify acquisition strategies and other transactional mechanisims for achieving desired goals		4,800		41125	28625
4. Public outreach and agency coordinations	3,125	3,125	3,125	3,125	12500
5. Project management and oversight	5,200	5,200	5,200	5,200	20,800
	115,283	120,083	68,575	49,450	295,925

I-016053

IX. Cost-sharing

There is no proposed cost share.

X. Applicant Qualifications

The Nature Conservancy (TNC) and Natural Heritage Institute (NHI) will manage this project collaboratively, but NHI will serve as fiscal agent and prime contractor. Two project teams will guide the project.

The River Ecosystem Team, made up of hydrologists, geomorphologists, riparian ecologists, and fish biologists, will be responsible for recommending flow releases on selected San Joaquin River tributaries. Brian Richter of TNC has developed computer software that enables rapid characterization of ecologically relevant characteristics of flow regimes (e.g. magnitude, timing, duration, frequency, rate of change) based on data available at USGS stream gages. This "Indicators of Hydrologic Alteration" (IHA) software will enable quantification of human-induced alterations in flow characteristics. Stillwater Associates has developed population models which allow the project team to link biological significance with geomorphic responses and flow alterations. McBain and Trush has applied their alluvial attributes approach to recommending flow releases and developing restoration strategies for the Trinity River in Northern California and Tuolumne River. Matt Kondolf (U.C. Berkeley) has supervised graduate research on three of the four San Joaquin tributaries and Peter Moyle (U.C. Davis) has conducted extensive field work in the valley. Wim Kimmerer (San Francisco State University) has extensive experience modeling salmonid flow interactions. Moyle, Kondolf, and Kimmerer all served as members of the core team that developed CALFED's strategic plan for ecosystem restoration.

The Water Management Team, made up of hydrologists, engineers, and planners and coordinated by David Fullerton of NHI, will identify and model promising water management strategies for obtaining the desired flow regimes in a cost-effective manner, while minimizing significant water supply or flood control impacts. The Team will screen water management scenarios to determine the best opportunities for re-operating the water supply infrastructure to meet restoration goals as well as existing water supply goals. Where the preliminary annual flow regime recommendations conflict with flood control objectives, the Team will identify cost-effective strategies for overcoming these constraints.

The Nature Conservancy

Brian Richter Ph.D is the new Director of The Nature Conservancy's Freshwater Initiative. He serves as a liaison to public agencies and other organizations involved in freshwater conservation, and leads of a staff that includes biohydrologists, aquatic ecologists, and educators. He works with science staff and conservation project teams across the U.S. and internationally to identify key hydrologic processes supporting biological diversity, assess alterations to these processes, and design conservation strategies for restoring desired hydrologic conditions. He has published numerous scientific papers on the importance of restoring natural flow regimes.

Natural Heritage Institute

NHI is a nonprofit natural resources law and technical consulting firm committed to improving the management and conservation of natural resources with expertise in water management and habitat restoration. NHI has been a leading representative of the environmental community in the CALFED process.

Gregory A. Thomas, J.D., President of NHI, will serve on the Water Management Team. Much of his practice has addressed issues in the Bay-Delta region.

Luna Leopold Ph.D, NHI Trustee, will serve on the River Ecosystem Team. Dr. Leopold is a founding father of the field of hydrology and pioneered the science of linking hydrologic characteristics to channel properties.
Peter Moyle, Ph.D., NHI Vice President and Trustee, will serve on the River Ecosystem Team. He is a professor of fisheries biology at the University of California, Davis. He has developed conservation strategies for California's native fishes that have been applied in his work as Head of the Delta Native Fishes Recovery Team and as a member of the science team for the Sierra Nevada Ecosystem Project.
John Cain, M.L.A., a restoration ecologist, will act as a link between the Project Ecosystem and Water Management Teams. He specializes in river restoration and water resources management. He conducted his graduate research on the historical geomorphic and hydrologic changes to the San Joaquin below Friant river and their implications for fisheries restoration.
David Fullerton, M.S. will lead the water management team. He specializes in California water management, technical and policy analysis of water issues, and negotiation of solutions to water use problems. He widely respected by a range of CALFED stakeholders for his objectivity, technical abilities, and water management ingenuity.
David Purkey, Ph.D. has extensive experience with hydrologic modeling, and surface/groundwater interactions.

G. Mathias Kondolph, Ph.D, a fluvial geomorphologist, will work on the River Ecosystem Team. He specializes in environmental river management, especially gravel-bed river channels, geomorphic influences on habitat for salmon and trout, effects of mining and dams on river systems, interactions of riparian vegetation and channel form, alternative flood management strategies, and assessment of ecological restoration.

William Kimmerer, Ph.D., will work on the River Ecosystem Team. He is an experienced scientist with substantial knowledge of aquatic ecosystems, including fisheries management. He is specialized in simulation models of salmon response to diversions and changes in flow and has worked in the Sacramento River system developing a population model for a study of the response of chinook salmon to river flows. Dr. Kimmerer has provided technical input and helped coordinate a series of workshops on the establishment of fresh water flow standards for San Francisco Bay.

Stillwater Sciences specializes in environmental management and restoration. Project applications include watershed analysis, environmental restoration, forest planning, hydroelectric operations, and integrated natural resource inventory and management. Stillwater's ongoing work includes research on gravel permeability as a factor in the spawning success of chinook salmon.

McBain and Trush
William Trush is a partner in McBain and Trush, Director of the Humboldt State University Institute for River Ecosystems, and an adjunct professor in the HSU Fisheries Department. He is a river ecologist specializing in river geomorphology, hydrology, and anadromous fish ecology. He has participated in several projects to prescribe variable flows for regulated rivers, including the Trinity River, Tuolumne River, Mono Basin tributaries, and tributaries in Crater Lake National Park.

List of Attachments

Attachment A - Figure 1: Location of Hydrology Restoration Study Area

Attachment B - Letters of Notification of Project Proposal

Attachment C - State Compliance Forms

Attachment D - Federal Compliance Forms

I-016057

ATTACHMENT A

I-016058

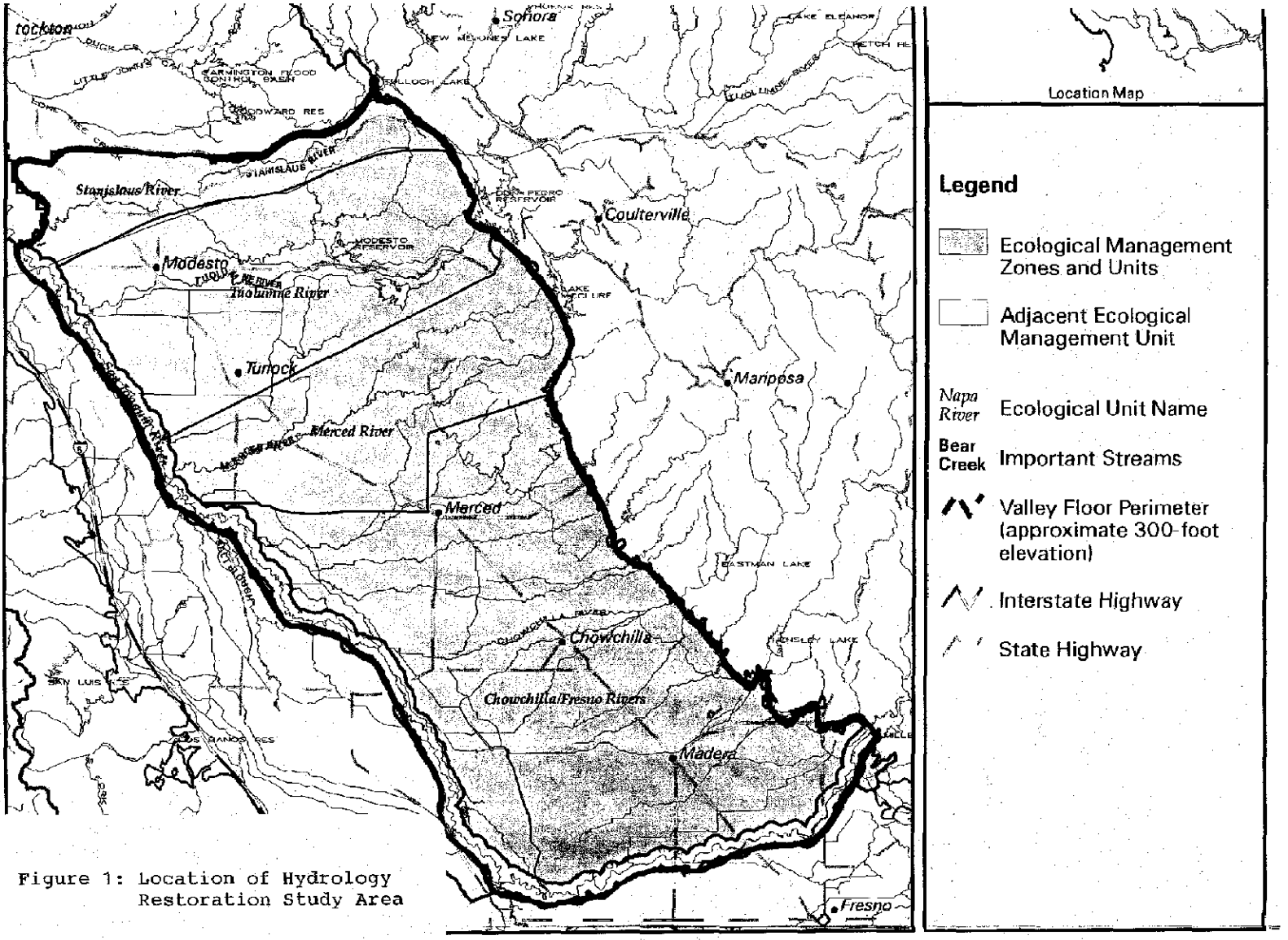

Figure 1: Location of Hydrology Restoration Study Area

Figure 18
East San Joaquin Basin
Ecological Management Zone

tem Restoration Program

I-016059

ATTACHMENT B

Natural Heritage Institute

114 SANSOME STREET, SUITE 1200
SAN FRANCISCO, CA 94104
TEL: (415) 288-0550/FAX: (415)288-0555
e-mail: nhi@n-h-i.org

Non-Profit Law and Consulting in Conservation of Natural Resources and the Global Environment

April 14, 1999

Ray Simon
Chairman
Stanislaus County Board of Supervisors
1100 H Street
Modesto, CA 95354

Dear Ray Simon:

This letter is to notify the Board of Supervisors that the Natural Heritage Institute (NHI), a nonprofit public interest law and consulting firm, is submitting an application to CALFED entitled *Focused Action to Develop Ecologically-Based Hydrologic Models and Water Management Strategies in the San Joaquin Basin*. This proposal describes a study to examine the ecological relationship between flows and restoration goals and to identify water management strategies to achieve restoration goals in the San Joaquin Basin, including your county.

This project is only a study; it will not entail any physical activities or implementation in your county. A copy of the executive summary of the proposal is attached.

Please feel free to contact me if you have any questions or concerns regarding this project. We will keep you informed should the proposal be successful.

Sincerely,

Gregory A. Thomas
President
Natural Heritage Institute

Cc: Kirk Ford
Environmental Coordinator
Stanislaus County
Department of Planning and Development

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Natural Heritage Institute

114 SANSOME STREET, SUITE 1200
SAN FRANCISCO, CA 94104
TEL: (415) 288-0550/FAX: (415)288-0555
e-mail: nhi@n-h-i.org

Non-Profit Law and Consulting in Conservation of Natural Resources and the Global Environment

April 14, 1999

Deidre F. Kelsey
Chairman
Merced County Board of Supervisors
2222 M Street
Merced, CA 95340

Dear Deidre F. Kelsey:

This letter is to notify the Board of Supervisors that the Natural Heritage Institute (NHI), a nonprofit public interest law and consulting firm, is submitting an application to CALFED entitled *Focused Action to Develop Ecologically-Based Hydrologic Models and Water Management Strategies in the San Joaquin Basin*. This proposal describes a study to examine the ecological relationship between flows and restoration goals and to identify water management strategies to achieve restoration goals in the San Joaquin Basin, including your county.

This project is only a study; it will not entail any physical activities or implementation in your county. A copy of the executive summary of the proposal is attached.

Please feel free to contact me if you have any questions or concerns regarding this project. We will keep you informed should the proposal be successful.

Sincerely,

Gregory A. Thomas
President
Natural Heritage Institute

Cc: Robert Smith
Director
Merced County
Department of Planning and Community Development

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I-016062

Natural Heritage Institute

114 SANSOME STREET, SUITE 1200
SAN FRANCISCO, CA 94104
TEL: (415) 288-0550/FAX: (415)288-0555
e-mail: nhi@n-h-i.org

Non-Profit Law and Consulting in Conservation of Natural Resources and the Global Environment

April 14, 1999

Gail Hanhart McIntyre
Chairman
Madera County Board of Supervisors
209 W. Yosemite Avenue
Madera, CA 93637

Dear Gail Hanhart McIntyre:

This letter is to notify the Board of Supervisors that the Natural Heritage Institute (NHI), a nonprofit public interest law and consulting firm, is submitting an application to CALFED entitled *Focused Action to Develop Ecologically-Based Hydrologic Models and Water Management Strategies in the San Joaquin Basin*. This proposal describes a study to examine the ecological relationship between flows and restoration goals and to identify water management strategies to achieve restoration goals in the San Joaquin Basin, including your county.

This project is only a study; it will not entail any physical activities or implementation in your county. A copy of the executive summary of the proposal is attached.

Please feel free to contact me if you have any questions or concerns regarding this project. We will keep you informed should the proposal be successful.

Sincerely,

Gregory A. Thomas
President
Natural Heritage Institute

Cc: Dave Merchen
Senior Planner and Environmental Coordinator
Madera County Planning Department

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I-016063

Natural Heritage Institute

114 SANSOME STREET, SUITE 1200
SAN FRANCISCO, CA 94104
TEL: (415) 288-0550/FAX: (415)288-0555
e-mail: nhien-h-i.org

Non-Profit Law and Consulting in Conservation of Natural Resources and the Global Environment

April 14, 1999

Robert J. Cabral
Chairman
San Joaquin County Board of Supervisors
222 E. Weber Avenue
Stockton, CA 95202

Dear Robert J. Cabral:

This letter is to notify the Board of Supervisors that the Natural Heritage Institute (NHI), a nonprofit public interest law and consulting firm, is submitting an application to CALFED entitled *Focused Action to Develop Ecologically-Based Hydrologic Models and Water Management Strategies in the San Joaquin Basin*. This proposal describes a study to examine the ecological relationship between flows and restoration goals and to identify water management strategies to achieve restoration goals in the San Joaquin Basin, including your county.

This project is only a study; it will not entail any physical activities or implementation in your county. A copy of the executive summary of the proposal is attached.

Please feel free to contact me if you have any questions or concerns regarding this project. We will keep you informed should the proposal be successful.

Sincerely,

Gregory A. Thomas
President
Natural Heritage Institute

Cc: John Pulver
Water Resources Coordinator
San Joaquin County Department of Public Works

I —016064

I-016064

Natural Heritage Institute

114 SANSOME STREET, SUITE 1200
SAN FRANCISCO, CA 94104
TEL: (415) 288-0550/FAX: (415)288-0555
e-mail: nhi@n-h-i.org

Non-Profit Law and Consulting in Conservation of Natural Resources and the Global Environment

April 14, 1999

Sharon Levy
Chairman
Fresno County Board of Supervisors
2281 Tulare Street
Hall of Records, Room 301
Fresno, CA 93721-2198

Dear Sharon Levy:

This letter is to notify the Board of Supervisors that the Natural Heritage Institute (NHI), a nonprofit public interest law and consulting firm, is submitting an application to CALFED entitled *Focused Action to Develop Ecologically-Based Hydrologic Models and Water Management Strategies in the San Joaquin Basin*. This proposal describes a study to examine the ecological relationship between flows and restoration goals and to identify water management strategies to achieve restoration goals in the San Joaquin Basin, including your county.

This project is only a study; it will not entail any physical activities or implementation in your county. A copy of the executive summary of the proposal is attached.

Please feel free to contact me if you have any questions or concerns regarding this project. We will keep you informed should the proposal be successful.

Sincerely,

Gregory A. Thomas
President
Natural Heritage Institute

Cc: Paul Marquez
Fresno County Department of Public Works

ATTACHMENT C

OF CALIFORNIA

NONDISCRIMINATION COMPLIANCE STATEMENT

TO. 19 (REV. 3-95) FMC

COMPANY NAME

NATURAL HERITAGE INSTITUTE (NHI)

The company named above (hereinafter referred to as "prospective contractor") hereby certifies, unless specifically exempted, compliance with Government Code Section 12990 (a-f) and California Code of Regulations, Title 2, Division 4, Chapter 5 in matters relating to reporting requirements and the development, implementation and maintenance of a Nondiscrimination Program. Prospective contractor agrees not to unlawfully discriminate, harass or allow harassment against any employee or applicant for employment because of sex, race, color, ancestry, religious creed, national origin, disability (including HIV and AIDS), medical condition (cancer), age, marital status, denial of family and medical care leave and denial of pregnancy disability leave.

CERTIFICATION

I, the official named below, hereby swear that I am duly authorized to legally bind the prospective contractor to the above described certification. I am fully aware that this certification, executed on the date and in the county below, is made under penalty of perjury under the laws of the State of California.

GREGORY A. THOMAS

OFFICIAL'S NAME

DATE EXECUTED: APRIL 15, 1999

EXECUTED IN THE COUNTY OF: SAN FRANCISCO

PROSPECTIVE CONTRACTOR'S SIGNATURE

PROSPECTIVE CONTRACTOR'S TITLE: PRESIDENT

PROSPECTIVE CONTRACTOR'S LEGAL BUSINESS NAME: GREGORY A. THOMAS NATURAL HERITAGE INSTITUTE

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I-016067

CALIFORNIA ALL-PURPOSE ACKNOWLEDGMENT

State of CALIFORNIA

County of SAN FRANCISCO

On April 15, 1999 (Date) before me, Marc N. Bader, Notary Public (Name and Title of Officer (e.g., "Jane Doe, Notary Public")),

personally appeared Gregory A. Thomas (Name(s) of Signer(s)),

☐ personally known to me – OR – ☑ proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/~~are~~ subscribed to the within instrument and acknowledged to me that he/~~she/they~~ executed the same in his/~~her/their~~ authorized capacity(~~ies~~), and that by his/~~her/their~~ signature(~~s~~) on the instrument the person(~~s~~), or the entity upon behalf of which the person(~~s~~) acted, executed the instrument.

MARC N. BADER
COMM. #1102314
Notary Public-California
SAN FRANCISCO
My Comm. Expires JUL. 29, 2000

WITNESS my hand and official seal.

Marc N. Bader
Signature of Notary Public

OPTIONAL

Though the information below is not required by law, it may prove valuable to persons relying on the document and could prevent fraudulent removal and reattachment of this form to another document.

Description of Attached Document

Title or Type of Document: Nondiscrimination Compliance Statement

Document Date: 4-15-99 Number of Pages: One

Signer(s) Other Than Named Above: N/A

Capacity(ies) Claimed by Signer(s)

Signer's Name:	Signer's Name:
☐ Individual	☐ Individual
☐ Corporate Officer	☐ Corporate Officer
Title(s):	Title(s):
☐ Partner — ☐ Limited ☐ General	☐ Partner — ☐ Limited ☐ General
☐ Attorney-in-Fact	☐ Attorney-in-Fact
☐ Trustee	☐ Trustee
☐ Guardian or Conservator	☐ Guardian or Conservator
☐ Other:	☐ Other:
Signer Is Representing:	Signer Is Representing:
RIGHT THUMBPRINT OF SIGNER — Top of thumb here	RIGHT THUMBPRINT OF SIGNER — Top of thumb here

 Prod. No. 5907 Reorder: Call Toll-Free 1-800-876-6827

I —016068

I-016068

State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES

Agreement No. _____

Exhibit _____

STANDARD CLAUSES –
SMALL BUSINESS PREFERENCE AND CONTRACTOR IDENTIFICATION NUMBER

NOTICE TO ALL BIDDERS:

Section 14835, et. seq. of the California Government Code requires that a five percent preference be given to bidders who qualify as a small business. The rules and regulations of this law, including the definition of a small business for the delivery of service, are contained in Title 2, California Code of Regulations, Section 1896, et. seq. A copy of the regulations is available upon request. Questions regarding the preference approval process should be directed to the Office of Small and Minority Business at (916) 322-5060. To claim the small business preference, you must submit a copy of your certification approval letter with your bid.

Are you claiming preference as a small business?

____ Yes* ✓ No

*Attach a copy of your certification approval letter.

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I-016069

ATTACHMENT D

I-016070

U.S. Department of the Interior

Certifications Regarding Debarment, Suspension and Other Responsibility Matters, Drug-Free Workplace Requirements and Lobbying

Persons signing this form should refer to the regulations referenced below for complete instructions:

Certification Regarding Debarment, Suspension, and Other Responsibility Matters - Primary Covered Transactions - The prospective primary participant further agrees by submitting this proposal that it will include the clause titled, "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transaction," provided by the department or agency entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions. See below for language to be used: use this form for certification and sign; or use Department of the Interior Form 1954 (DI-1954). (See Appendix A of Subpart D of 43 CFR Part 12.)

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions - (See Appendix B of Subpart D of 43 CFR Part 12.)

Certification Regarding Drug-Free Workplace Requirements - Alternate I. (Grantees Other Than Individuals) and Alternate II. (Grantees Who are Individuals) - (See Appendix C of Subpart D of 43 CFR Part 12)

Signature on this form provides for compliance with certification requirements under 43 CFR Parts 12 and 18. The certifications shall be treated as a material representation of fact upon which reliance will be placed when the Department of the Interior determines to award the covered transaction, grant, cooperative agreement or loan.

PART A: Certification Regarding Debarment, Suspension, and Other Responsibility Matters - Primary Covered Transactions

CHECK ✓ IF THIS CERTIFICATION IS FOR A PRIMARY COVERED TRANSACTION AND IS APPLICABLE.

(1) The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

(b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

(2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

PART B: Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions

CHECK__ IF THIS CERTIFICATION IS FOR A LOWER TIER COVERED TRANSACTION AND IS APPLICABLE.

(1) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

(2) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

DI-2010
March 1990
(This form consolidates DI-1953, DI-1954.

PART C: Certification Regarding Drug-Free Workplace Requirements

CHECK ✓ IF THIS CERTIFICATION IS FOR AN APPLICANT WHO IS NOT AN INDIVIDUAL.

Alternate I. (Grantees Other Than Individuals)

A. The grantee certifies that it will or continue to provide a drug-free workplace by:

(a) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the grantee's workplace and specifying the actions that will be taken against employees for violation of such prohibition;

(b) Establishing an ongoing drug-free awareness program to inform employees about--
(1) The dangers of drug abuse in the workplace;
(2) The grantee's policy of maintaining a drug-free workplace;
(3) Any available drug counseling, rehabilitation, and employee assistance programs; and
(4) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;

(c) Making it a requirement that each employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (a);

(d) Notifying the employee in the statement required by paragraph (a) that, as a condition of employment under the grant, the employee will --
(1) Abide by the terms of the statement; and
(2) Notify the employer in writing of his or her conviction for a violation of a criminal drug statute occurring in the workplace no later than five calendar days after such conviction;

(e) Notifying the agency in writing, within ten calendar days after receiving notice under subparagraph (d)(2) from an employee or otherwise receiving actual notice of such conviction. Employers of convicted employees must provide notice, including position title, to every grant officer on whose grant activity the convicted employee was working, unless the Federal agency has designated a central point for the receipt of such notices. Notice shall include the identification numbers(s) of each affected grant;

(f) Taking one of the following actions, within 30 calendar days of receiving notice under subparagraph (d)(2), with respect to any employee who is so convicted --
(1) Taking appropriate personnel action against such an employee, up to and including termination, consistent with the requirements of the Rehabilitation Act of 1973, as amended; or
(2) Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency;

(g) Making a good faith effort to continue to maintain a drug-free workplace through implementation of paragraphs (a) (b), (c), (d), (e) and (f).

B. The grantee may insert in the space provided below the site(s for the performance of work done in connection with the specific grant:

Place of Performance (Street address, city, county, state, zip code)

114 Sansome Street, Suite 1200

San Francisco, CA 94104 San Francisco county

Check___if there are workplaces on file that are not identified here.

PART D: Certification Regarding Drug-Free Workplace Requirements

CHECK___IF THIS CERTIFICATION IS FOR AN APPLICANT WHO IS AN INDIVIDUAL.

Alternate II. (Grantees Who Are Individuals)

(a) The grantee certifies that, as a condition of the grant, he or she will not engage in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance in conducting any activity with the grant;

(b) If convicted of a criminal drug offense resulting from a violation occurring during the conduct of any grant activity, he or she will report the conviction, in writing, within 10 calendar days of the conviction, to the grant officer or other designee, unless the Federal agency designates a central point for the receipt of such notices. When notice is made to such a central point, it shall include the identification number(s) of each affected grant.

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PART E: Certification Regarding Lobbying
Certification for Contracts, Grants, Loans, and Cooperative Agreements

CHECK ✓ IF CERTIFICATION IS FOR THE AWARD OF ANY OF THE FOLLOWING AND THE AMOUNT EXCEEDS $100,000: A FEDERAL GRANT OR COOPERATIVE AGREEMENT; SUBCONTRACT, OR SUBGRANT UNDER THE GRANT OR COOPERATIVE AGREEMENT.

CHECK __ IF CERTIFICATION IS FOR THE AWARD OF A FEDERAL LOAN EXCEEDING THE AMOUNT OF $150,000, OR A SUBGRANT OR SUBCONTRACT EXCEEDING $100,000, UNDER THE LOAN.

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, and officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

As the authorized certifying official, I hereby certify that the above specified certifications are true.

SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL

TYPED NAME AND TITLE Gregory A. Thomas, President, NHI

DATE April 15, 1999

I —016073

APPLICATION FOR FEDERAL ASSISTANCE

OMB Approval No. 03

2. DATE SUBMITTED	Applicant Identifier
April 15, 1999	
3. DATE RECEIVED BY STATE	State Application Identifier
4. DATE RECEIVED BY FEDERAL AGENCY	Federal Identifier

1. TYPE OF SUBMISSION:

Application	Preapplication
☐ Construction	☐ Construction
☒ Non-Construction	☐ Non-Construction

5. APPLICANT INFORMATION

Legal Name:	Organizational Unit:
Natural Heritage Institute	
Address *(give city, county, State, and zip code):*	Name and telephone number of person to be contacted on matters involving this application *(give area code)*
114 Sansome St, Suite 1200 San Francisco, CA 94104 S.F. county	John Cain (415) 288-0550

6. EMPLOYER IDENTIFICATION NUMBER *(EIN):*

9 4 – 3 0 9 9 6 0 0

7. TYPE OF APPLICANT: *(enter appropriate letter in box)* N

A. State — H. Independent School Dist.
B. County — I. State Controlled Institution of Higher Learning
C. Municipal — J. Private University
D. Township — K. Indian Tribe
E. Interstate — L. Individual
F. Intermunicipal — M. Profit Organization
G. Special District — N. Other (Specify) non-profit organization

8. TYPE OF APPLICATION:

☒ New ☐ Continuation ☐ Revision

If Revision, enter appropriate letter(s) in box(es) ☐ ☐

A. Increase Award B. Decrease Award C. Increase Duration
D. Decrease Duration Other *(specify):*

9. NAME OF FEDERAL AGENCY:

CALFED

10. CATALOG OF FEDERAL DOMESTIC ASSISTANCE NUMBER:

☐☐ – ☐☐☐

TITLE:

11. DESCRIPTIVE TITLE OF APPLICANT'S PROJECT:

Focused Action to Develop Ecologicall Based Hydrologic Models and Water Management Strategies in the San Joaquin Basin

12. AREAS AFFECTED BY PROJECT *(Cities, Counties, States, etc.):*

San Joaquin, Madera, Merced, Fresno, Stanislaus counties

13. PROPOSED PROJECT

Start Date	Ending Date
10/1999	10/2000

14. CONGRESSIONAL DISTRICTS OF:

a. Applicant	b. Project
District 8	Districts 11, 18, 19, 20

15. ESTIMATED FUNDING:

a. Federal	$ 295,925 .00
b. Applicant	$ .00
c. State	$ .00
d. Local	$ .00
e. Other	$ .00
f. Program Income	$ .00
g. TOTAL	$ 295,925 .00

16. IS APPLICATION SUBJECT TO REVIEW BY STATE EXECUTIVE ORDER 12372 PROCESS?

a. YES. THIS PREAPPLICATION/APPLICATION WAS MADE AVAILABLE TO THE STATE EXECUTIVE ORDER 12372 PROCESS FOR REVIEW ON:

DATE _____

b. No. ☐ PROGRAM IS NOT COVERED BY E. O. 12372
☐ OR PROGRAM HAS NOT BEEN SELECTED BY STATE FOR REVIEW

17. IS THE APPLICANT DELINQUENT ON ANY FEDERAL DEBT?

☐ Yes If "Yes," attach an explanation. ☒ No

18. TO THE BEST OF MY KNOWLEDGE AND BELIEF, ALL DATA IN THIS APPLICATION/PREAPPLICATION ARE TRUE AND CORRECT, THE DOCUMENT HAS BEEN DULY AUTHORIZED BY THE GOVERNING BODY OF THE APPLICANT AND THE APPLICANT WILL COMPLY WITH THE ATTACHED ASSURANCES IF THE ASSISTANCE IS AWARDED.

a. Type Name of Authorized Representative	b. Title	c. Telephone Number
Gregory A. Thomas	President	(415) 288-0550
d. Signature of Authorized Representative		**e. Date Signed**
		April 15, 1999

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I –016074

I-016074

OMB Approval No. 0348-0044

BUDGET INFORMATION - Non-Construction Programs

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1.		$	$	$	$	$
2.						
3.						
4.						
5. Totals		$	$	$	$	$

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY (1)	(2)	(3)	(4)	Total (5)
a. Personnel	$	$	$	$	$
b. Fringe Benefits					
c. Travel					
d. Equipment					
e. Supplies					
f. Contractual					
g. Construction					
h. Other					
i. Total Direct Charges (sum of 6a-6h)					
j. Indirect Charges					
k. TOTALS (sum of 6i and 6j)	$	$	$	$	$
7. Program Income	$	$	$	$	$

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SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8.	$	$	$	$
9.				
10.				
11.				
12. TOTAL (sum of lines 8 - 11)	$	$	$	$

SECTION D - FORCASTED CASH NEEDS

	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	$	$	$	$	$
14. NonFederal					
15. TOTAL (sum of lines 13 and 14)					

SECTION E - BUDGET ESTIMATES OF FEDERAL FUNDS NEEDED FOR BALANCE OF THE PROJECT

(a) Grant Program	FUTURE FUNDING PERIODS (Years)			
	(b) First	(c) Second	(d) Third	(e) Fourth
16.	$	$	$	$
17.				
18.				
19.				
20. TOTAL (sum of lines 16-19)	$	$	$	$

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges:	22. Indirect Charges:
23. Remarks:	

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ASSURANCES - NON-CONSTRUCTION PROGRAMS

PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE OFFICE OF MANAGEMENT AND BUDGET. SEND IT TO THE ADDRESS PROVIDED BY THE SPONSORING AGENCY.

NOTE: Certain of these assurances may not be applicable to your project or program. If you have questions, please contact the awarding agency. Further, certain Federal awarding agencies may require applicants to certify to additional assurances. If such is the case, you will be notified.

As the duly authorized representative of the applicant, I certify that the applicant:

1. Has the legal authority to apply for Federal assistance and the institutional, managerial and financial capability (including funds sufficient to pay the non-Federal share of project cost) to ensure proper planning, management and completion of the project described in this application.

2. Will give the awarding agency, the Comptroller General of the United States and, if appropriate, the State, through any authorized representative, access to and the right to examine all records, books, papers, or documents related to the award; and will establish a proper accounting system in accordance with generally accepted accounting standards or agency directives.

3. Will establish safeguards to prohibit employees from using their positions for a purpose that constitutes or presents the appearance of personal or organizational conflict of interest, or personal gain.

4. Will initiate and complete the work within the applicable time frame after receipt of approval of the awarding agency.

5. Will comply with the Intergovernmental Personnel Act of 1970 (42 U.S.C. §§4728-4763) relating to prescribed standards for merit systems for programs funded under one of the 19 statutes or regulations specified in Appendix A of OPM's Standards for a Merit System of Personnel Administration (5 C.F.R. 900, Subpart F).

6. Will comply with all Federal statutes relating to nondiscrimination. These include but are not limited to: (a) Title VI of the Civil Rights Act of 1964 (P.L. 88-352) which prohibits discrimination on the basis of race, color or national origin; (b) Title IX of the Education Amendments of 1972, as amended (20 U.S.C. §§1681-1683, and 1685-1686), which prohibits discrimination on the basis of sex; (c) Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. §794), which prohibits discrimination on the basis of handicaps; (d) the Age Discrimination Act of 1975, as amended (42 U.S.C. §§6101-6107), which prohibits discrimination on the basis of age; (e) the Drug Abuse Office and Treatment Act of 1972 (P.L. 92-255), as amended, relating to nondiscrimination on the basis of drug abuse; (f) the Comprehensive Alcohol Abuse and Alcoholism Prevention, Treatment and Rehabilitation Act of 1970 (P.L. 91-616), as amended, relating to nondiscrimination on the basis of alcohol abuse or alcoholism; (g) §§523 and 527 of the Public Health Service Act of 1912 (42 U.S.C. §§290 dd-3 and 290 ee 3), as amended, relating to confidentiality of alcohol and drug abuse patient records; (h) Title VIII of the Civil Rights Act of 1968 (42 U.S.C. §§3601 et seq.), as amended, relating to nondiscrimination in the sale, rental or financing of housing; (i) any other nondiscrimination provisions in the specific statute(s) under which application for Federal assistance is being made; and, (j) the requirements of any other nondiscrimination statute(s) which may apply to the application.

7. Will comply, or has already complied, with the requirements of Titles II and III of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (P.L. 91-646) which provide for fair and equitable treatment of persons displaced or whose property is acquired as a result of Federal or federally-assisted programs. These requirements apply to all interests in real property acquired for project purposes regardless of Federal participation in purchases.

8. Will comply, as applicable, with provisions of the Hatch Act (5 U.S.C. §§1501-1508 and 7324-7328) which limit the political activities of employees whose principal employment activities are funded in whole or in part with Federal funds.

...ply, as applicable, with the provisions of the Davis-Bacon Act (40 U.S.C. §§276a to 276a-7), the Copeland Act (40 U.S.C. §276c and 18 U.S.C. §874), and the Contract Work Hours and Safety Standards Act (40 U.S.C. §§327-333), regarding labor standards for federally-assisted construction subagreements.

10. Will comply, if applicable, with flood insurance purchase requirements of Section 102(a) of the Flood Disaster Protection Act of 1973 (P.L. 93-234) which requires recipients in a special flood hazard area to participate in the program and to purchase flood insurance if the total cost of insurable construction and acquisition is $10,000 or more.

11. Will comply with environmental standards which may be prescribed pursuant to the following: (a) institution of environmental quality control measures under the National Environmental Policy Act of 1969 (P.L. 91-190) and Executive Order (EO) 11514; (b) notification of violating facilities pursuant to EO 11738; (c) protection of wetlands pursuant to EO 11990; (d) evaluation of flood hazards in floodplains in accordance with EO 11988; (e) assurance of project consistency with the approved State management program developed under the Coastal Zone Management Act of 1972 (16 U.S.C. §§1451 et seq.); (f) conformity of Federal actions to State (Clean Air) Implementation Plans under Section 176(c) of the Clean Air Act of 1955, as amended (42 U.S.C. §§7401 et seq.); (g) protection of underground sources of drinking water under the Safe Drinking Water Act of 1974, as amended (P.L. 93-523); and, (h) protection of endangered species under the Endangered Species Act of 1973, as amended (P.L. 93-205).

12. Will comply with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. §§1271 et seq.) related to protecting components or potential components of the national wild and scenic rivers system.

13. Will assist the awarding agency in assuring compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. §470), EO 11593 (identification and protection of historic properties), and the Archaeological and Historic Preservation Act of 1974 (16 U.S.C. §§469a-1 et seq.).

14. Will comply with P.L. 93-348 regarding the protection of human subjects involved in research, development, and related activities supported by this award of assistance.

15. Will comply with the Laboratory Animal Welfare Act of 1966 (P.L. 89-544, as amended, 7 U.S.C. §§2131 et seq.) pertaining to the care, handling, and treatment of warm blooded animals held for research, teaching, or other activities supported by this award of assistance.

16. Will comply with the Lead-Based Paint Poisoning Prevention Act (42 U.S.C. §§4801 et seq.) which prohibits the use of lead-based paint in construction or rehabilitation of residence structures.

17. Will cause to be performed the required financial and compliance audits in accordance with the Single Audit Act Amendments of 1996 and OMB Circular No. A-133, "Audits of States, Local Governments, and Non-Profit Organizations."

18. Will comply with all applicable requirements of all other Federal laws, executive orders, regulations, and policies governing this program.

SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL	TITLE
	PRESIDENT
APPLICANT ORGANIZATION	DATE SUBMITTED
NATURAL HERITAGE INSTITUTE	APRIL 15, 1999

Standard Form 424B (Rev. 7-97) Back

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